

IN THE CLAIMS:

This listing of the claims replaces all prior versions and listings of the claims in this application.

The text of all pending claims (including any withdrawn claims) is set forth below. Canceled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strike through~~. The status of each claim is indicated with one of (Original), (Currently amended), (Canceled), (Withdrawn), (Previously presented), (New), and (Not entered).

The changes indicated below are relative to the latest versions of the claims, which are claims 2 and 4 as they appear in the Response to Office Action of July 8, 2009, and claims 1, 3, and 7-11 as they appear in the Examiner's Amendment included in the Notice of Allowance of March 22, 2010.

Please AMEND claims 1-4 and 7-11 in accordance with the following:

1. (Currently amended) An ultra wideband radio transmitter comprising:
 - a delay time controller for generating a periodic pulse, inputting the periodic pulse to a first matched filter, outputting the periodic pulse to a second matched filter when transmission data has a first level out of 2 logical levels, outputting the periodic pulse to a third matched filter when the transmission data has a second level out of the 2 logical levels;
 - the first matched filter for outputting a reference signal that becomes a data decision criterion when the periodic pulse is input thereto;
 - the second matched filter for outputting a first data signal a predetermined time ahead of the reference signal when the periodic pulse is input thereto;
 - the third matched filter for outputting a second data signal a predetermined time behind the reference signal when the periodic pulse is input thereto;
 - an adder for adding up outputs of the first to third matched filters;
 - a local oscillator for outputting a local signal for frequency-converting ~~a corresponding an~~ addition signal of the adder at a high frequency band or a low frequency band;
 - a mixer for receiving the addition signal and the local signal, and frequency-converting the ~~corresponding~~ addition signal; and

an antenna for receiving the frequency-converted addition signal and radiating the frequency-converted addition signal in the air.

2. (Currently amended) The ultra wideband radio transmitter of claim 1, wherein the reference signal, the first data ~~signal~~ signal, and the second data signal each are a pattern signal comprised of several periodic pulses.

3. (Currently amended) An ultra wideband radio receiver comprising:
an antenna for receiving a radio wave signal;
a local oscillator for outputting a local signal for frequency-converting the radio wave signal;
a mixer for receiving the radio wave signal and the local signal, and frequency-converting the radio wave signal;
a first matched filter for receiving the frequency-converted radio wave signal, and outputting a first output signal when a reference signal that becomes a data decision criterion is detected therefrom;
a second matched filter for receiving the frequency-converted radio wave signal, and outputting a second output signal when a data signal is detected therefrom;
a delay time measurer for detecting which of the first output signal and the second output signal has been first output from the first and second matched filters, and outputting a corresponding detection result; and
a data decider for receiving the detection result and deciding whether the data signal has a first level or a second level out of 2 logical ~~levels~~ levels;
wherein the delay time measurer ~~comprises~~ comprises:
a first circuit for receiving the first output signal and calculating a square value or an absolute value of the first output signal,
a second circuit for receiving the second output signal and calculating a square value or an absolute value of the second output signal,
a first latch for receiving and setting an output signal of the first circuit,
a second latch for receiving and setting an output signal of the second circuit,
a first memory for reading an output signal of the ~~second~~ first latch as the detection result by receiving a ~~output~~ an output signal of the ~~first~~ second latch,

a second memory for reading the output signal of the ~~first~~second latch as the detection result by receiving the output signal of the ~~second~~first latch, and
a reset section for outputting a reset signal by receiving ~~outputs~~ the output signal of the first latch, ~~and second latches~~.

4. (Currently amended) The ultra wideband radio receiver of claim 3, wherein the reference signal and the data signal each are a pattern signal ~~comprised of~~ comprising several periodic pulses.

5.-6. (Canceled)

7. (Currently amended) An ultra wideband radio transmitter ~~including~~ comprising a first radio section for performing data communication using a first frequency, a second radio section for performing data communication using a second frequency being different from the first frequency, and an interface section for allocating transmission data to the first and second radio sections, the transmitter comprising:

the first radio section ~~including~~ comprising:

a first delay time controller for generating a periodic pulse by receiving transmission data allocated by the interface, inputting the periodic pulse to a first matched filter, outputting the periodic pulse to a second matched filter when the transmission data has a first level out of 2 logical levels, and outputting the periodic pulse to a third matched filter when the transmission data has a second level out of the 2 logical levels,

the first matched filter for outputting a reference signal that becomes a data decision criterion when the periodic pulse is input thereto,

the second matched filter for outputting a first data signal a predetermined time ahead of the reference signal when the periodic signal is input ~~thereto~~; thereto,

the third matched filter for outputting a second data signal a predetermined time behind the reference signal when the periodic pulse is input thereto, ~~and~~

a first adder for adding up outputs of the first to third matched ~~filters~~; filters, and

a first antenna for receiving a ~~corresponding~~ a first addition signal of the first adder and radiating the first addition signal in the air; and

the second radio section ~~including~~ comprising:

a second delay time controller for generating a periodic pulse by receiving transmission data allocated by the interface, inputting the periodic pulse to a fourth matched filter, outputting the periodic pulse to a fifth matched filter when the transmission data has a first level out of 2 logical levels, and outputting the periodic pulse to a sixth matched filter when the transmission data has a second level out of the 2 logical levels,

the fourth matched filter for outputting a reference signal that becomes a data decision criterion when the periodic pulse is input thereto,

the fifth matched filter for outputting a first data signal a predetermined time ahead of the reference signal when the periodic signal is input thereto,

the sixth matched filter for outputting a second data signal a predetermined time behind the reference signal when the periodic pulse is input thereto,

a second adder for adding up outputs of the fourth to sixth matched filters,

a local oscillator for outputting a local signal for frequency-converting a ~~corresponding~~ second addition signal of the second adder,

a mixer for receiving the second addition signal and the local signal, and frequency-converting the second addition signal, and

an antenna for receiving the frequency-converted second addition signal and radiating the frequency-converted second addition signal in the air.

8. (Currently amended) An ultra wideband radio receiver ~~including~~ comprising a first radio section for performing data communication using a first ~~frequency~~ frequency, and a second radio section for performing data communication using a second frequency being different from the first frequency, the receiver comprising:

the first radio section comprising:

a first antenna for receiving a radio wave signal and outputting the ~~received~~ radio wave signal to a first matched filter and a second matched ~~filter;~~ filter.

the first matched filter for receiving a ~~the~~ radio wave signal from the first antenna, and outputting a first output signal when a reference signal that becomes a data decision criterion is ~~detected therefrom;~~ therefrom.

the second matched filter for receiving a ~~a~~ the radio wave signal from the first antenna, and outputting a second output signal when a data signal is ~~detected therefrom;~~ therefrom.

a first delay time measurer for detecting which of the first output signal and the second output signal has been first output from the first and second matched filters, and outputting a corresponding ~~detecting result~~; first detection result, and

a first data decider for receiving the first detection result, and deciding whether the data signal has a first level or a second level out of 2 logical levels; and

the second radio section ~~including~~ comprising:

a second antenna for receiving a radio wave signal,

a local oscillator for outputting a local signal for frequency-converting the radio wave signal,

a mixer for receiving the radio wave signal and the local signal, and frequency-converting the radio wave signal,

a third matched filter for receiving the frequency-converted radio wave signal, and outputting a third output signal when a reference signal that becomes a data decision criterion is detected therefrom,

a fourth matched filter for receiving the frequency-converted radio wave signal, and outputting a fourth output signal when a data signal is detected ~~therefrom~~ therefrom,

a second delay time measurer for detecting which of the third output signal and the fourth output signal has first been output from the third and fourth matched filters, and outputting a corresponding second detection result, and

a second data decider for receiving the ~~detecting~~ second detection result, and deciding whether the data signal has a first level or a second level out of 2 logical ~~levels~~, levels;

wherein the first delay time measurer ~~comprises~~ comprises:

a first circuit for receiving the first output signal and calculating a square value or an absolute value of the first output signal,

a second circuit for receiving the second output signal and calculating a square value or an absolute value of the second output signal,

a first latch for receiving and setting a ~~output~~ an output signal of the first circuit,

a second latch for receiving and setting a ~~output~~ an output signal of the second circuit,

a first memory for reading a ~~output~~ an output signal of the ~~second~~ first latch as the first detection result by receiving a ~~output~~ an output signal of the ~~first~~ second latch,

a second memory for reading the output signal of the ~~first~~second latch as the first detection result by receiving the output signal of the ~~second~~first latch, and

a reset section for outputting a reset signal by receiving ~~outputs~~ the output signal of the ~~first and second latches~~ latch; and/or

wherein the second delay time measurer comprises:

a third circuit for receiving the third output signal and calculating a square value or an absolute value of the third output signal,

a fourth circuit for receiving the fourth output signal and calculating a square value or an absolute value of the fourth output signal,

a third latch for receiving and setting an output signal of the third circuit,

a fourth latch for receiving and setting an output signal of the fourth circuit,

a third memory for reading an output signal of the third latch as the second detection result by receiving an output signal of the fourth latch,

a fourth memory for reading the output signal of the fourth latch as the second detection result by receiving the output signal of the third latch, and

a reset section for outputting a reset signal by receiving the output signal of the third latch.

9. (Currently amended) An ultra wideband radio transmitter ~~including~~ comprising a first radio section for performing data communication using a first frequency, a second radio section for performing data communication using a second frequency being different from the first frequency, and an interface for allocating transmission data to the first and second radio sections, the transmitter comprising:

the first radio section ~~including~~ comprising:

a first delay time controller for generating a periodic pulse by receiving transmission data allocated by the interface, inputting the periodic pulse to a first matched filter, outputting the periodic pulse to a second matched filter when the transmission data has a first level out of 2 logical levels, and outputting the periodic pulse to a third matched filter when the transmission data has a second level of the 2 logical levels,

the first matched filter for outputting a reference signal that becomes a data decision criterion when the periodic pulse is input thereto,

the second matched filter for outputting a first data signal a predetermined time ahead of the reference signal when the periodic pulse is input thereto,

the third matched filter for outputting a second data signal a predetermined time behind the reference signal when the periodic pulse is input thereto,

a first adder for adding up outputs of the first to third matched filters, and

~~a first antenna~~ for receiving ~~a corresponding a first~~ addition signal of the first adder, and radiating the first addition signal in the air; and

the second radio section ~~including~~ comprising:

a second delay time controller for generating a periodic pulse by receiving transmission data allocated by the interface, inputting the periodic pulse to a fourth matched filter, outputting the periodic pulse to a fifth matched filter when the transmission data has a first level out of 2 logical levels, and outputting the periodic pulse to a sixth matched filter when the transmission data has a second level of the 2 logical levels,

the fourth matched filter for outputting a reference signal that becomes a data decision criterion when the periodic pulse is input thereto,

the fifth matched filter for outputting a first data signal a predetermined time ahead of the reference signal when the periodic pulse is input thereto,

the sixth matched filter for outputting a second data signal a predetermined time behind the reference signal when the periodic pulse is input thereto,

a second adder for adding up outputs of the fourth to sixth matched filters,

a local oscillator for outputting a local signal for frequency-converting a ~~corresponding second~~ addition signal of the second adder from the first frequency to the second frequency, and

a mixer for receiving the second addition signal and the local signal, frequency-converting the second addition signal, and outputting the frequency-converted second addition signal to the ~~first~~ antenna.

10. (Currently amended) An ultra wideband radio receiver ~~including~~ comprising a first radio section for performing data communication using a first ~~frequency~~ frequency, and a second radio section for performing data communication using a second frequency being different from the first frequency, the receiver comprising:

the first radio section comprising:

~~a first antenna~~ for receiving a radio wave signal and outputting the received radio wave signal to a first matched filter, a second matched filter, and a mixer in the second ~~radio section;~~ section.

the first matched filter for receiving ~~a the radio wave signal~~ from the first antenna, and outputting a first output signal when a reference signal that becomes a data decision criterion is detected ~~therefrom;~~ therefrom.

the second matched filter for receiving ~~a the radio wave signal~~ from the first antenna, and outputting a second output signal when a data signal is detected ~~therefrom;~~ therefrom.

a first delay time measurer for detecting which of the first output signal and the second output signal has been first output from the first and second matched filters, and outputting a corresponding ~~detecting result;~~ first detection result, and

a first data decider for receiving the first detection result, and deciding whether the data signal has a first level or a second level out of 2 logical levels; and

the second radio section ~~including~~ comprising:

a local oscillator for outputting a local signal for frequency-converting ~~a the radio wave signal~~ received from the first antenna,

a mixer for receiving the radio wave signal from the first antenna and the local signal, and frequency-converting the radio wave signal,

a third matched filter for receiving the frequency-converted radio wave signal, and outputting a third output signal when a reference signal that becomes a data decision criterion is detected therefrom,

a fourth matched filter for receiving the frequency-converted radio wave signal, and outputting a fourth output signal when a data signal is detected therefrom,

a second delay time measurer for detecting which of the third output signal and the fourth output signal has first been output from the third and fourth matched filters, and outputting a corresponding second detection result, and

a second data decider for receiving the ~~detecting~~ second detection result, and deciding whether the data signal has a first level or a second level out of 2 logical ~~levels;~~ levels;

wherein the first delay time measurer comprises:

a first circuit for receiving the first output signal and calculating a square value or an absolute value of the first output signal,

a second circuit for receiving the second output signal and calculating a square value or an absolute value of the second output signal,

a first latch for receiving and setting ~~a output~~ an output signal of the first circuit,

a second latch for receiving and setting ~~a output~~ an output signal of the second circuit,

a first memory for reading ~~a output~~ an output signal of the ~~second~~ first latch as the first detection result by receiving ~~a output~~ an output signal of the ~~first~~ second latch,

a second memory for reading the output signal of the ~~first~~ second latch as the first detection result by receiving the output signal of the ~~second~~ first latch, and

a reset section for outputting a reset signal by receiving ~~outputs~~ the output signal of the ~~first and second latches~~ latch; and/or

wherein the second delay time measurer comprises:

a third circuit for receiving the third output signal and calculating a square value or an absolute value of the third output signal,

a fourth circuit for receiving the fourth output signal and calculating a square value or an absolute value of the fourth output signal,

a third latch for receiving and setting an output signal of the third circuit,

a fourth latch for receiving and setting an output signal of the fourth circuit,

a third memory for reading an output signal of the third latch as the second detection result by receiving an output signal of the fourth latch,

a fourth memory for reading the output signal of the fourth latch as the second detection result by receiving the output signal of the third latch, and

a reset section for outputting a reset signal by receiving the output signal of the third latch.

11. (Currently amended) An ultra wideband radio communication ~~system~~, system comprising:

an ultrawideband radio transmitter comprising:

a delay time controller which generates a periodic pulse, inputs the periodic pulse to a first matched filter, outputs the periodic pulse to a second matched filter when transmission data has a first level out of 2 logical levels, and outputs the periodic pulse to a third matched filter when the transmission data has a second level out of 2 logical levels;

the first matched filter which outputs a reference signal that becomes a data decision criterion when the periodic pulse is input thereto;

the second matched filter which outputs a first data signal a predetermined time ahead of the reference signal when the periodic pulse is input thereto;

the third matched filter which outputs a second data signal a predetermined time behind the reference signal when the periodic pulse is input thereto;

an adder which adds up outputs of the first to third matched filters;

a local oscillator which outputs a local signal for frequency-converting a corresponding addition signal at a high frequency band or a low frequency band;

a mixer which receives the addition signal and the local signal, and frequency-converts the addition signal; and

an antenna which receives the frequency-converted addition signal, and radiates the corresponding signal in the air; and

an ultra wideband radio receiver, ~~comprises~~ receiver comprising:

an antenna which receives a radio wave signal and outputs the ~~corresponding~~ radio wave signal to a second mixer;

the second mixer which receives ~~a~~ the radio wave signal and a local signal that a local oscillator outputs to frequency-convert the radio wave signal, and frequency-converts the ~~addition~~ radio wave signal;

a fourth matched filter which receives the frequency-converted radio wave signal, and outputs a first output signal when a reference signal that becomes a data decision criterion is detected therefrom;

a fifth matched filter which receives the frequency-converted radio wave signal, and outputs a second output signal when a data signal is detected therefrom;

a delay time measurer which detects which of the first output signal and the second output signal has been first output from the fourth and fifth matched filters, and outputs a corresponding detection result; and

a data decider which receives the detection result, and decides whether the data signal has a first level or a second level out of 2 logical ~~levels~~, levels;

wherein the delay time measurer ~~comprises~~ comprises:

a first circuit for receiving the first output signal and calculating a square value or an absolute value of the first output signal,

a second circuit for receiving the second output signal and calculating a square value or an absolute value of the second output signal,

a first latch for receiving and setting an output signal of the first circuit,

a second latch for receiving and setting an output signal of the second circuit,

a first memory for reading an output signal of the ~~second~~first latch as the detection result by receiving an output signal of the ~~first~~second latch,

a second memory for reading the output signal of the ~~first~~second latch as the detection result by receiving the output signal of the ~~second~~first latch; and

a reset section for outputting a reset signal by receiving ~~outputs~~the output signal of the ~~first~~latch, ~~and second latches~~.